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Background

Energy drinks are advertised as a way to increase energy and alertness when experiencing insufficient sleep. In addition, energy drinks have become popular amongst college students when studying for exams. The energy drink market grew nearly 400% from 2003-2007 (Howard & Marczynski, 2010). Therefore, it is important to learn more about the uses and effects of these drinks.

A special type of brain wave, the P300, is typically produced when the participant is presented with a stimulus deemed to be rare and particularly meaningful (Luck, 2005). Participants experiencing fatigue produced a larger P300 after consuming caffeine as compared to a placebo, suggesting caffeine increased arousal levels and improved participants' ability to recognize and respond to the stimulus (Ruijter, Lorist, Snel & Ruiter, 2000).

Despite the large amount of research regarding caffeine, few studies have investigated the effects of energy drinks, such as 5-hour energy. This drink contains caffeine plus an "energy blend" consisting of supplemental ingredients, such as vitamins B6, B12, Niacin, Folic Acid, tyrosine, taurine (5-hour ENERGY, <http://www.5hourenergy.com/ingredients.asp>).

Research Question

"Does the energy blend contained in energy drinks improve a person's P300 amplitude and latency time on visual attention tasks compared to caffeine alone?"

Hypothesis

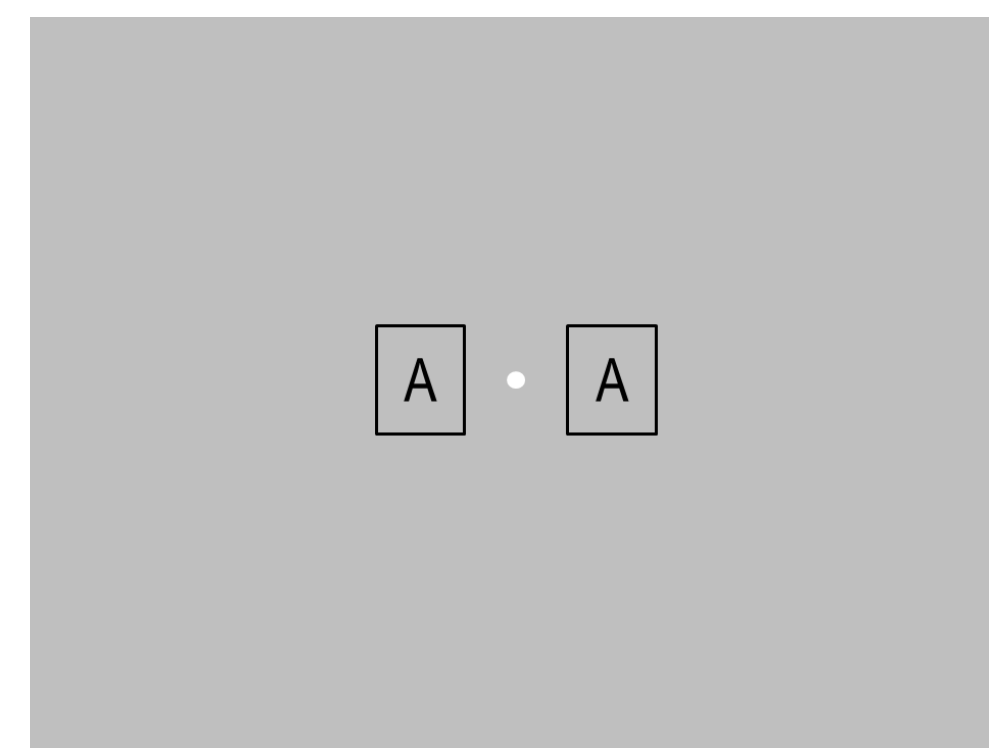
- ❖ P300 will be greater and latency time will be faster in the caffeine and energy drink conditions as compared to the placebo
- ❖ Energy drink P300 and latency time will not be significantly different from the caffeine only condition

Method

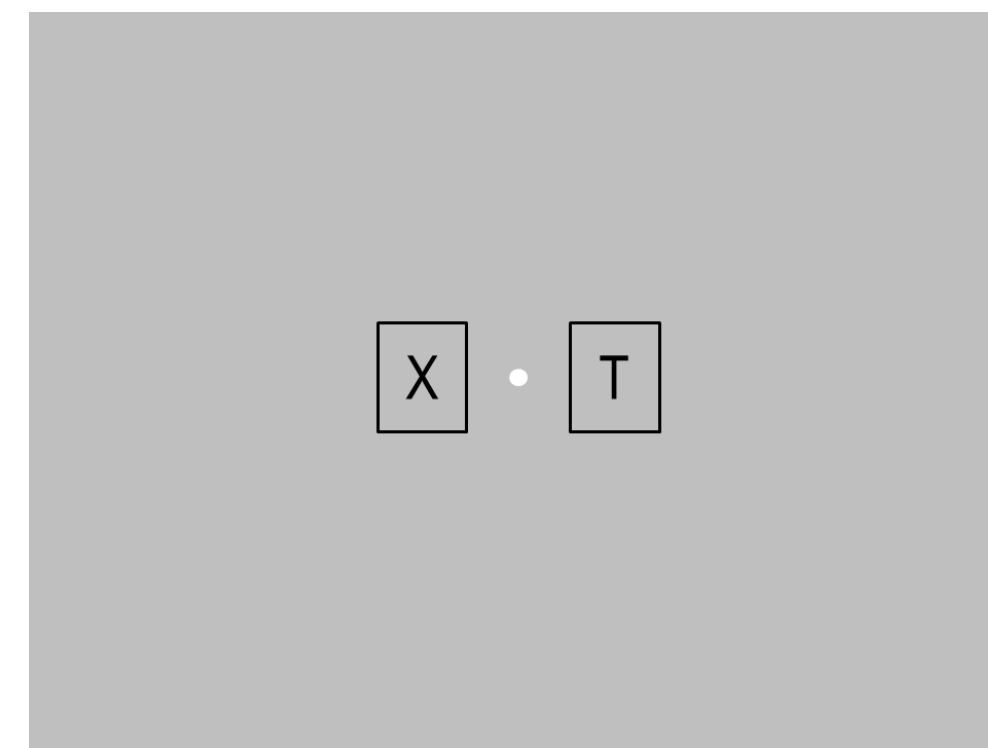
- ❖ Participants: 31 Centre College Undergraduate Students
- ❖ Conditions: Placebo, Caffeine Only, and Energy Drink
- ❖ Dependent Measures: P300 mean peak amplitude and latency time for target stimulus
- ❖ Materials: Electroencephalogram, PsyTask
- ❖ Procedure
 - ~Pre-Screening Form and Pre-Testing Survey
 - Screen for skin, caffeine, and artificial sweetener sensitivities along with vision and attention disorders; screen for prior caffeine consumption and sleep history
 - ~Consent form, weigh participants to titrate conditioned drink, and then consume drink
 - ~Fit subject with EEG cap during 30-minute period
 - ~Describe attention task, and then perform practice attention task
 - ~Record 2-minute baseline
 - ~Complete vigilance task using an oddball paradigm with experimenter monitoring EEG
 - Task consists of 500 trials: 100 target trials and 400 non-target trials
 - ~Stress and arousal survey post-test and a follow-up questionnaire 24 hours later

Attention Task Stimuli

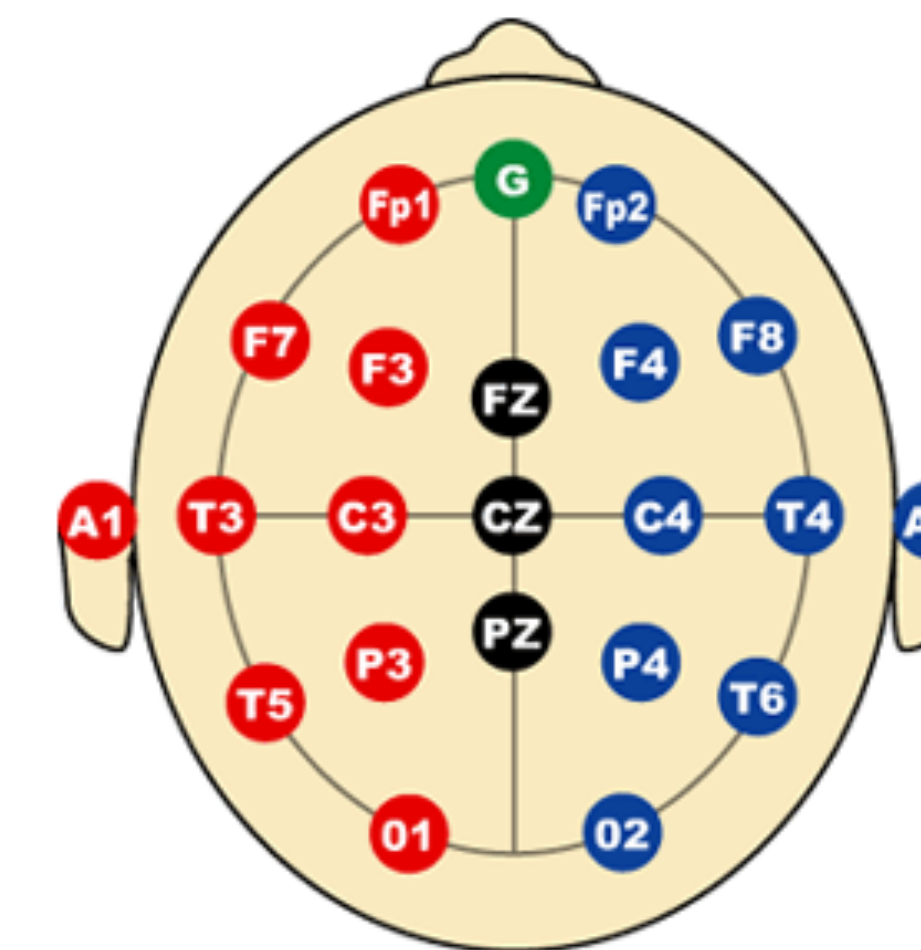
Non-Target (4)



Target (1)



Electrode Locations

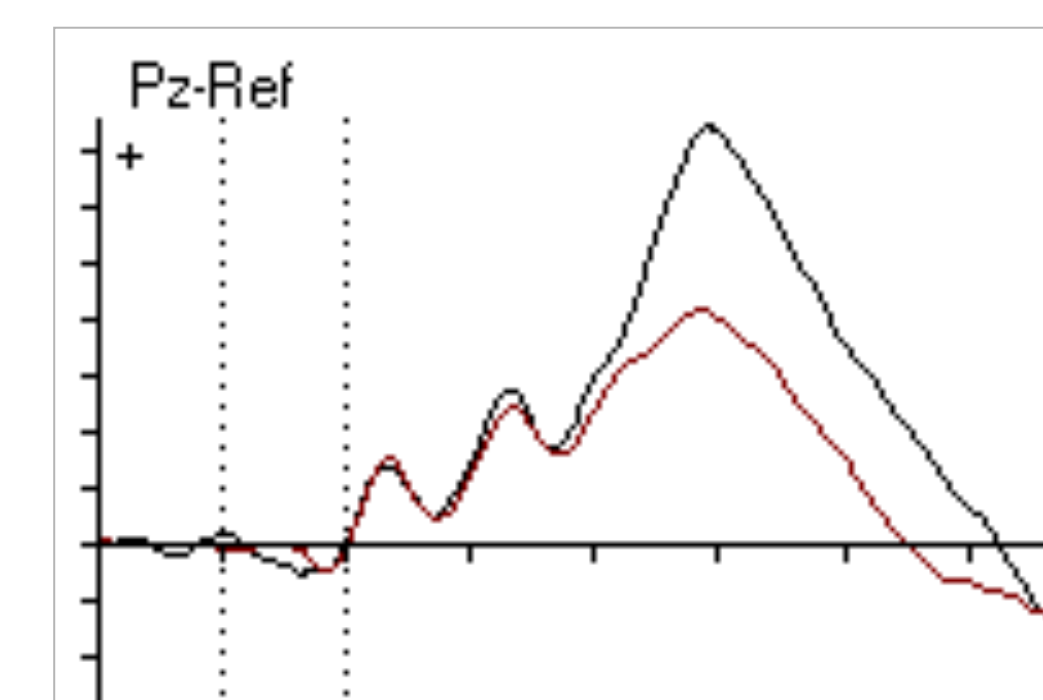
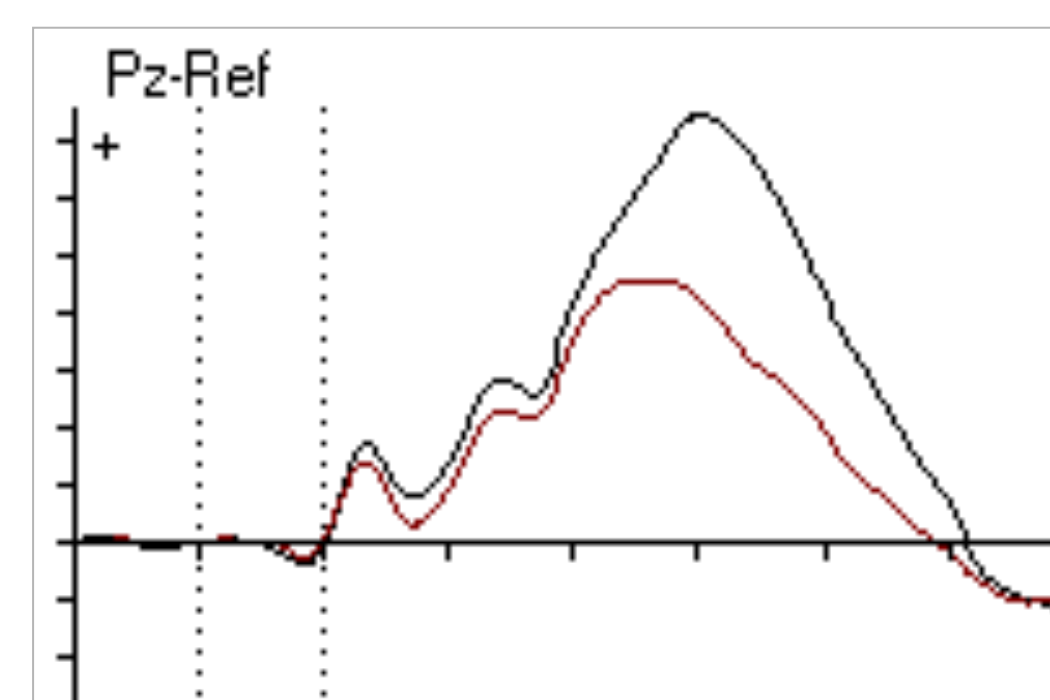
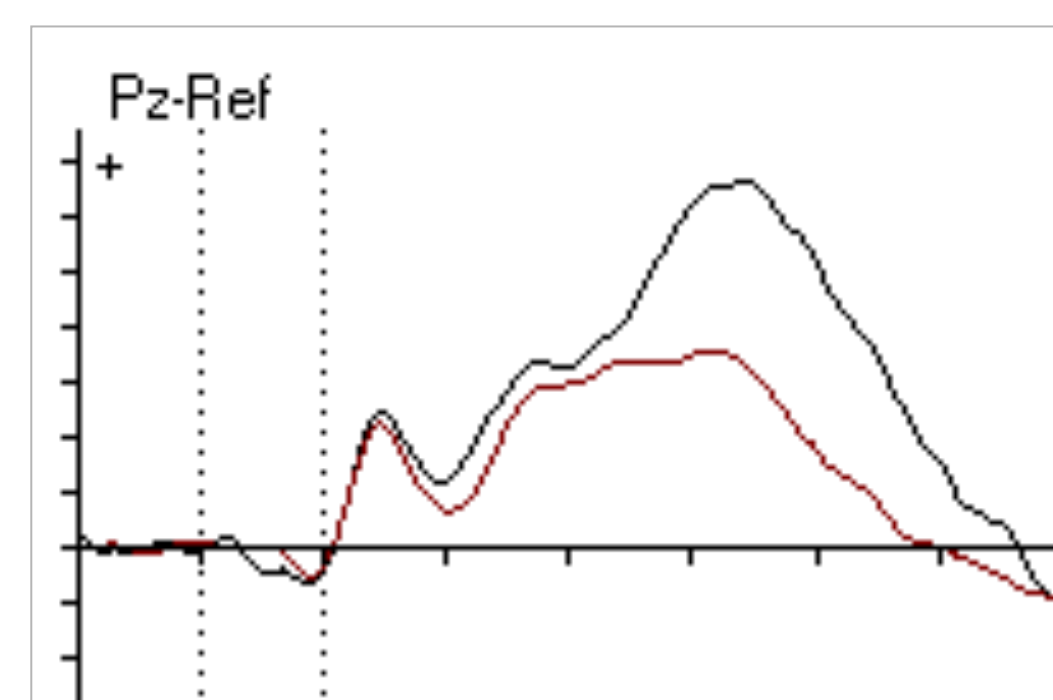
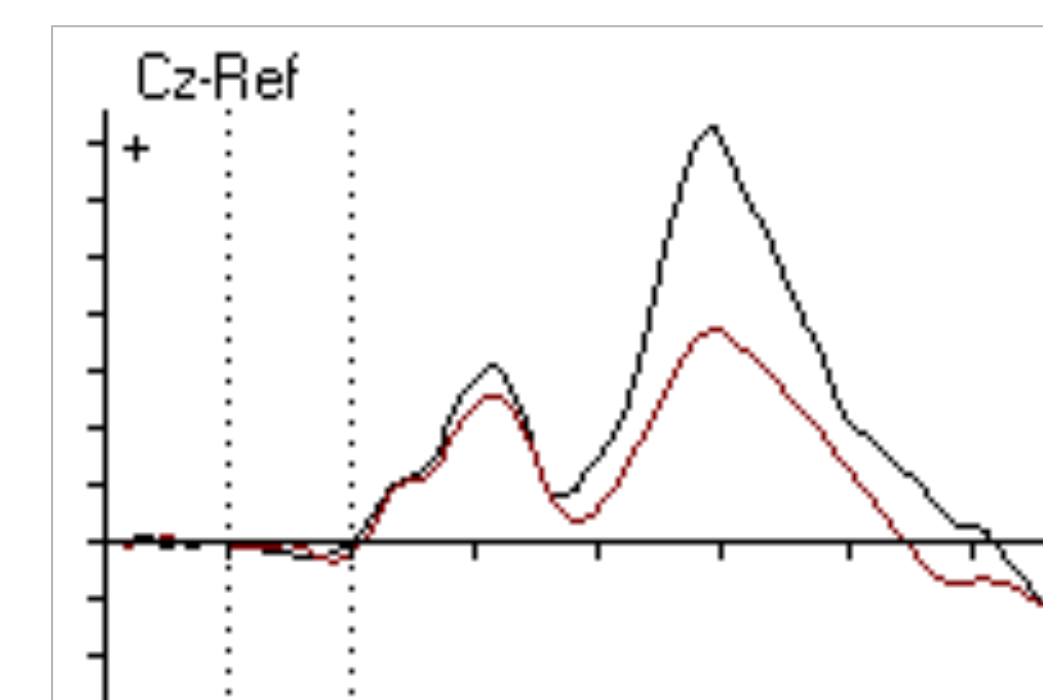
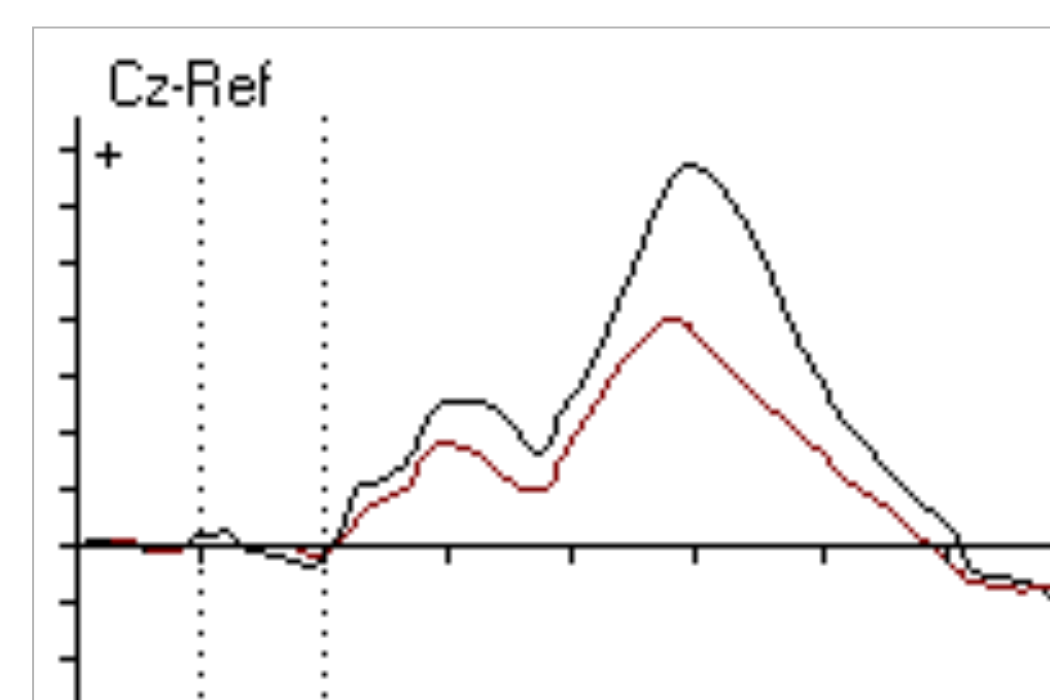
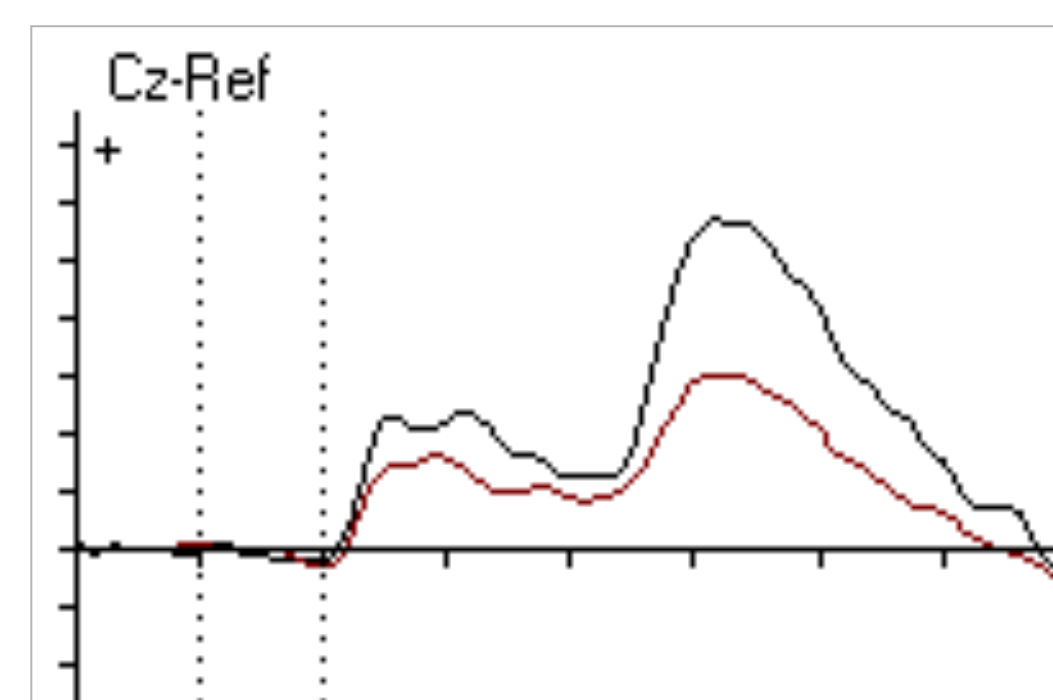
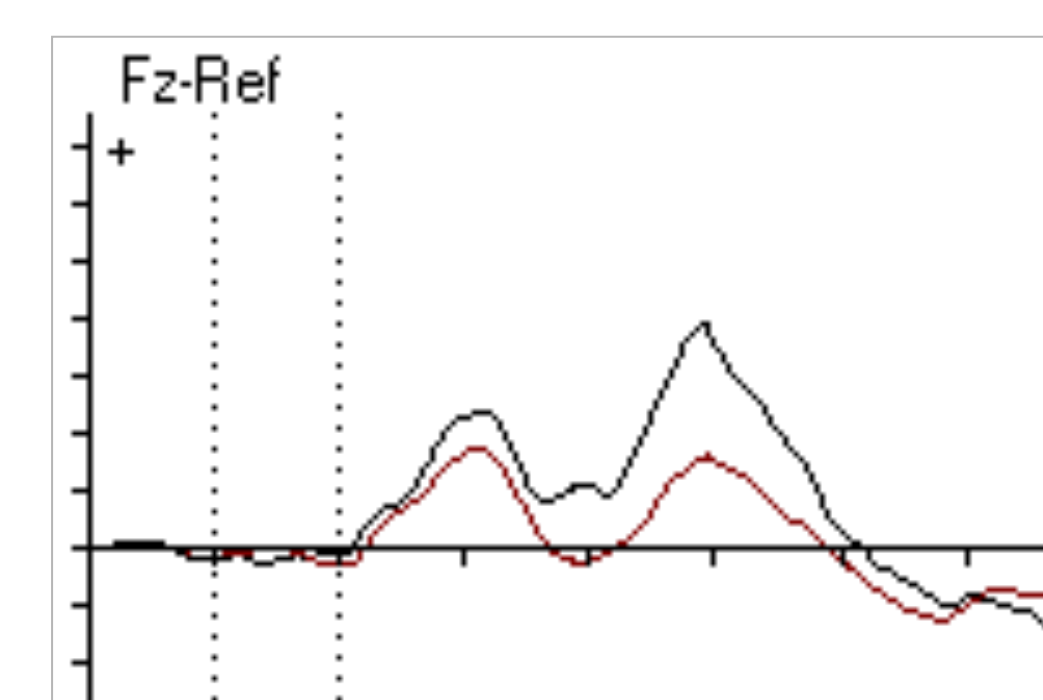
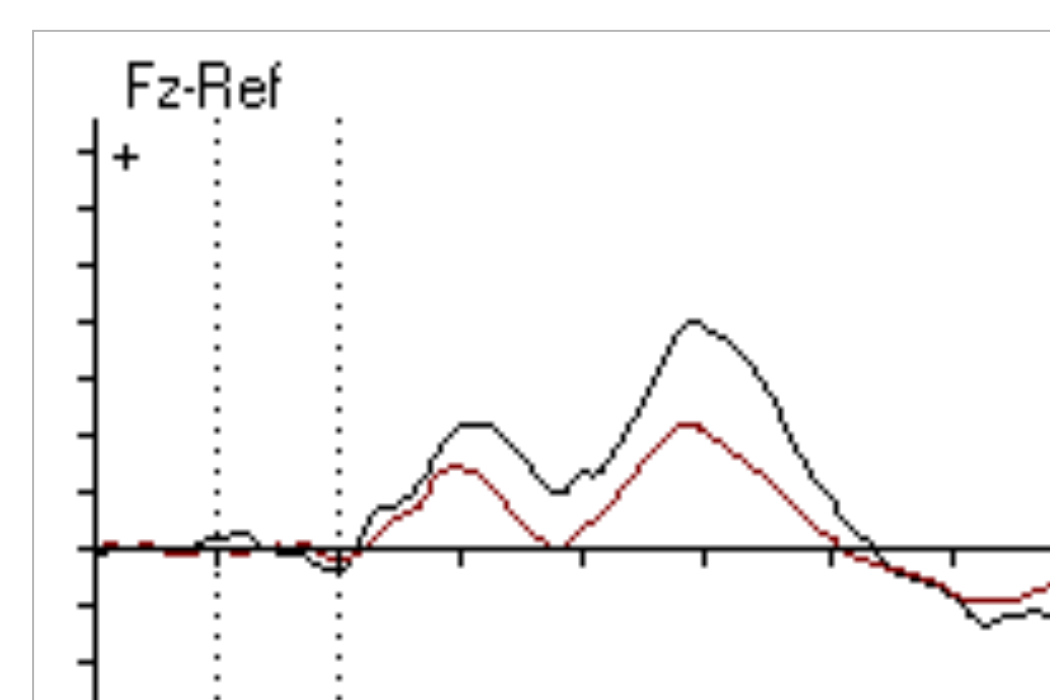
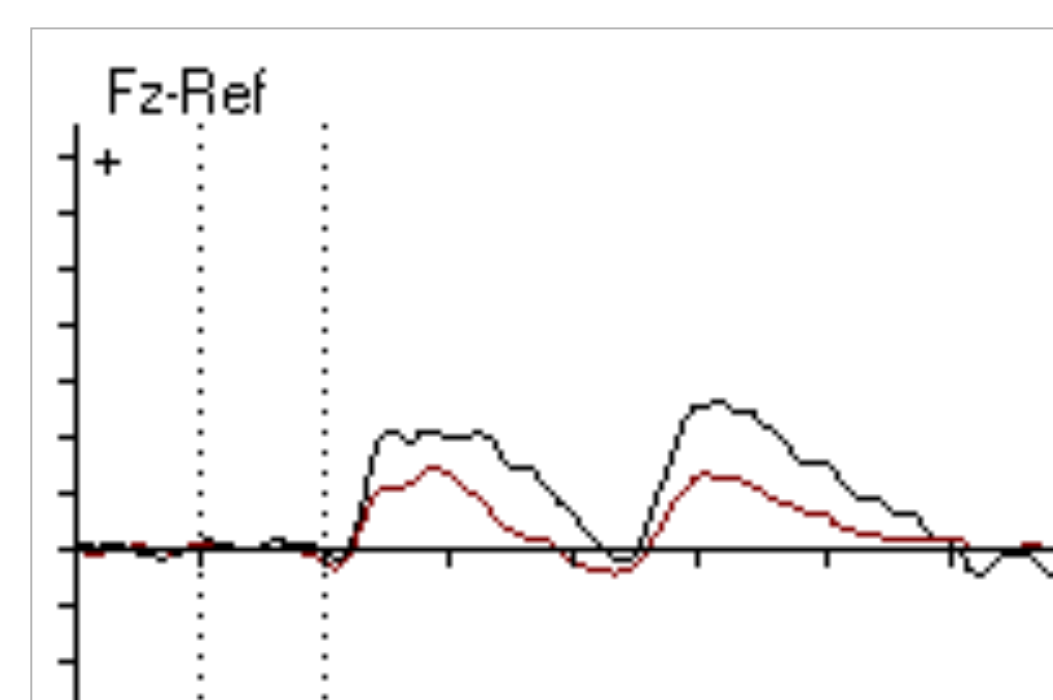


P300 Amplitudes

Placebo

Caffeine Only

Energy Drink



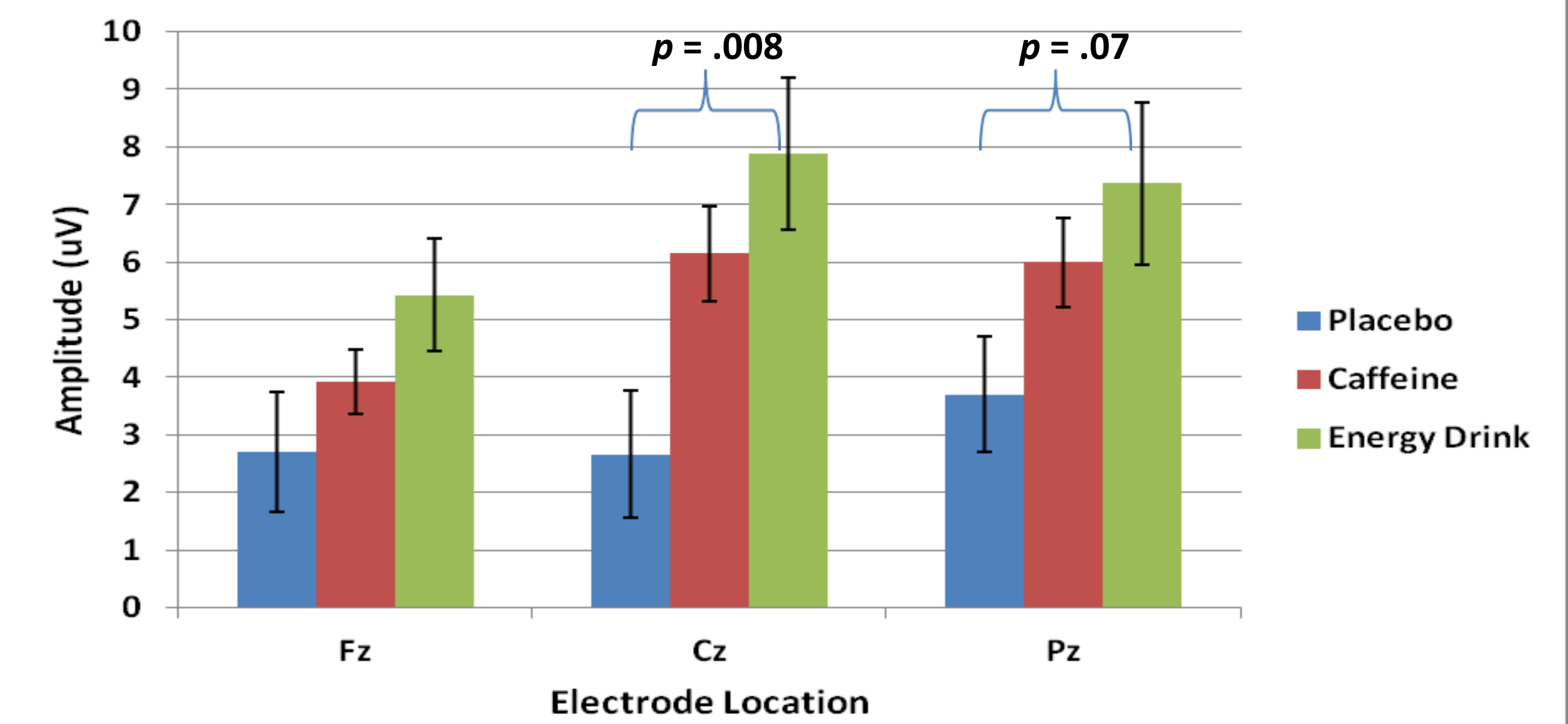
Legend: _____ Target
_____ Non-Target

Stimuli Presentation
Trial Start

+6µV
200ms
Time (ms)

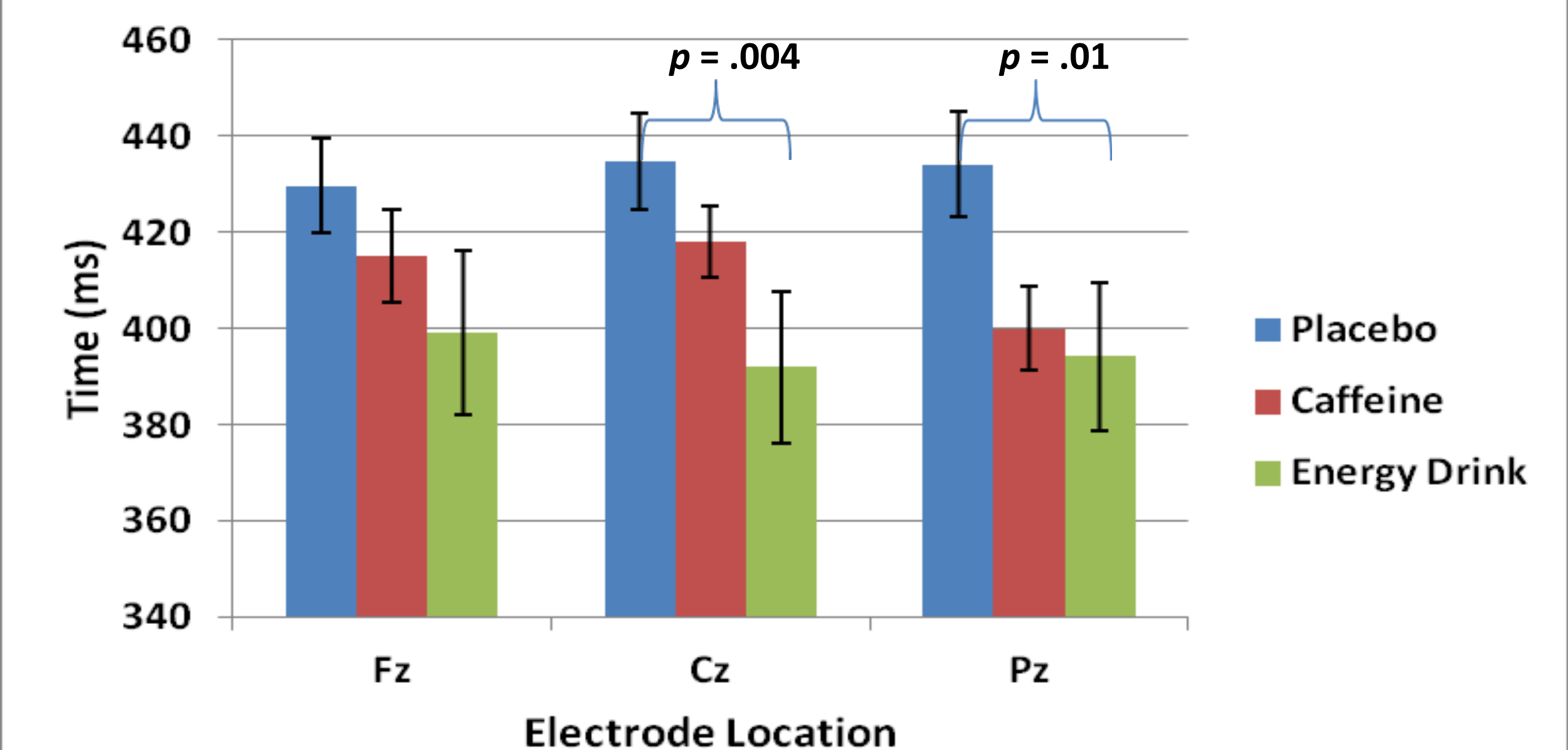
Results

Difference Scores for Mean Peak Amplitude



In our 1-way between subjects ANOVA, there were significant effects of drink condition on P300 amplitude at the $p < .05$ level for the three conditions at Cz ($F(2,28) = 5.689, p = 0.008$) and approaching significance at Pz ($p = 0.07$).

Latency of Stimulus Recognition



In our 1-way between subjects ANOVA, there were significant effects of drink condition on P300 latency at the $p < .05$ level for the three conditions at Cz ($F(2,28) = 6.822, p = 0.004$) and Pz ($F(2,28) = 5.414, p = 0.01$).

Implications and Future Directions

- ❖ Energy drinks and caffeine increase arousal significantly more than the placebo (Cz and Pz)
- ❖ The "energy blend" does not appear to enhance performance more than caffeine only
- ❖ Investigate alternative energy drink brands with differing "energy blends"
- ❖ Investigate placebo effects

References

- Howard, M. A., Marczynski, C. A. (2010). Acute effects of a glucose energy drink on behavioral control. *Experimental and Clinical Psychopharmacology*, 18, 553-561.
- Luck, S. J. (2005). *An introduction to the event-related potential technique*. Cambridge: Massachusetts Institute of Technology Press.
- Ruijter, J., Lorist, M. M., Snel, J., & de Ruiter, M. B. (2000). The influence of caffeine on sustained attention: An ERP study. *Pharmacology Biochemistry and Behavior*, 66, 29-37.
- 5-hour ENERGY, <http://www.5hourenergy.com/ingredients.asp>